What is claimed is:

1. A heterodyne laser interferometer using a heterogeneous mode helium-neon laser and a super heterodyne phase measuring method, comprising a laser light source part 70, an optical interferometer 60, a frequency converter 80 and a phase measurer 90,

wherein the laser light source part uses a heterogeneous mode helium-neon laser generator 71, output light emitted from the laser generator has two frequencies that are perpendicular to each other and linearly polarized, a part 75 of the output light is used as a reference signal and the remaining output light 74 is used as a measured signal.

2. The heterodyne laser interferometer as claimed in claim 1, wherein the reference signal is obtained in such a manner that a part of the output light passes through a polarizer 72 whose polarization axis is tilted at 45° to the light having two frequencies to interfere and then passes through a photo-detector 73 to be converted into an electric signal 76, the reference signal being represented by

$$V_r = A\cos[2\pi(f_1 - f_2)t]$$

where V_R is the reference signal, A is the amplitude of the signal, and f_1 and f_2 are frequency components included in the output light.

3. The heterodyne laser interferometer as claimed in claim 1, wherein the measured signal is obtained in such a manner that the remaining output light is inputted into a polarization splitter 62 to be split so that light 67 having a frequency component f_1 travels to a fixed reflecting mirror 61 and light 66 having a frequency component f_2 travels to a moving reflecting mirror 63 attached to a moving object, the lights inputted into the fixed reflecting mirror and the moving reflecting mirror are reflected and combined by a polarizer 64 whose polarization axis is tilted at 45° to the lights to interfere with each other, the combined light is inputted to a photo-detector 65, and the light inputted into the photo-detector is converted into an electric signal, the measured signal being represented by

$$V_m = B\cos\{2\pi(f_1 - f_2)t + 2nd_1/\lambda_1 - 2nd_2/\lambda_2\}$$

where V_m is the measured signal, B is the amplitude of the signal, λ_1 and λ_2 mean wavelengths of the lights having the frequency components f_1 and f_2, respectively, d_1 is a distance that the light having the frequency component f_1 has traveled in the air, d_2 is a distance that the light having the frequency component f_2 has traveled in the air, and n is the reflective index of air.

4. The heterodyne laser interferometer as claimed in claim 1, wherein a local oscillator 82 creates a local signal 87 approximate to a beat frequency corresponding to the reference signal, a signal splitter 83 splits the local signal 87 into two signals 88 and 89, mixers 86 and 81 multiply the split signals 88 and 89 by the reference signal 76 and the measured signal 68, respectively, a filter

84 eliminates a signal corresponding to the sum of the reference signal and the local signal among the output signal 91 of the mixer that multiplies the reference signal by the local signal, a phase meter 100 receives a signal corresponding to the difference of the reference signal and the local signal, a filter 85 eliminates a signal corresponding to the sum of the measured signal and the local signal among the output signal 92 of the mixer that multiplies the measured signal by the local signal, the phase meter 100 accepts a signal corresponding to the difference of the measured signal and the local signal, to thereby measure a phase.

5. The heterodyne laser interferometer as claimed in claim 4, wherein the signal corresponding to the difference of the reference signal and the local signal is represented by

$$V_m' = A\cos 2\pi ft$$

and the signal corresponding to the difference of the measured signal and the local signal is represented by

$$V_m' = B\cos\{2\pi(ft + 2nd_1/\lambda_1 - 2nd_2/\lambda_2\}$$

where $f = f_1 - f_2 - f_{LO}$, f_{LO} is the frequency of a local oscillation signal, f_1 and f_2 are frequency components included in output lights, λ_1 and λ_2 mean wavelengths of the lights having the frequency components f_1 and f_2, respectively, d_1 is a distance that the light having the frequency component f_1 has traveled in the air, d_2 is a distance that the light having the frequency component f_2 has traveled in the air, and n is the reflective index of air.

6. The heterodyne laser interferometer as claimed in claim 3, wherein a signal splitter 116 splits a measured signal 115, which was converted into an electric signal, into two signals 121 and 122, a mixer 117 multiplies one of the split signals 121 and 122 by a local oscillation signal 123 whose frequency is $f_b + f$, a mixer 118 multiplies the other signal 122 by a local oscillation signal 124 whose frequency is $f_b - f$, radio frequency components of outputs 125 and 126 of the mixers are eliminated by filters 119 and 120, to generate a signal 127 having a frequency $f+\Delta f$ and a signal 128 having a frequency $f-\Delta f$, phase measurement is carried out using the signal 127 having the frequency $f+\Delta f$ when Doppler frequency has a positive sign, and phase measurement is performed using the signal 128 having the frequency $f-\Delta f$ when the Doppler frequency has a negative sign.

7. A heterodyne laser interferometer using a heterogeneous mode helium-neon laser and a super heterodyne phase measuring method, comprising a laser light source part 70, an optical interferometer 60, a frequency converter 80 and a phase measurer 90,

wherein the laser light source part uses a heterogeneous mode helium-neon laser generator 71, output light emitted from the laser generator has two frequencies that are perpendicular to each other and linearly polarized, a part 75 of the output light is used as a reference signal and the remaining output light 74 is used as a measured signal,

the reference signal is obtained in such a manner that a part of the output light passes through a polarizer 72 whose polarization axis is tilted at 45° to the light having two frequencies to interfere and then passes through a photo-detector 73 to be converted into an electric signal 76,

the measured signal is obtained in such a manner that the remaining output light is inputted into a polarization splitter 62 to be split so that light 67 having a frequency component f_1 travels to a fixed reflecting mirror 61 and light 66 having a frequency component f_2 travels to a moving reflecting mirror 63 attached to a moving object, the lights inputted into the fixed reflecting mirror and the moving reflecting mirror are reflected and combined by a polarizer 64 whose polarization axis is tilted at 45° to the lights to interfere with each other, the combined light is inputted to a photo-detector 65, and the light inputted into the photo-detector is converted into an electric signal,

a local oscillator 82 creates a local signal 87 approximate to a beat frequency corresponding to the reference signal, a signal splitter 83 splits the local signal 87 into two signals 88 and 89, mixers 86 and 81 multiply the split signals 88 and 89 by the reference signal 76 and the measured signal 68, respectively, a filter 84 eliminates a signal corresponding to the sum of the reference signal and the local signal among the output signal 91 of the mixer that multiplies the reference signal by the local signal, a phase meter 100 receives a signal corresponding to the difference of the reference signal and the local signal, a filter 85 eliminates a signal corresponding to the sum of the measured signal and the local signal among the output signal 92 of the mixer

that multiplies the measured signal by the local signal, the phase meter 100 accepts a signal corresponding to the difference of the measured signal and the local signal, to thereby measure a phase.